NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE SPECIFICATIONS

RESIDUE MANAGEMENT, MULCH TILL

(Acre)
Code 329B

GENERAL SPECIFICATIONS:

The following specifications provide additional guidance to ensure proper implementation of this practice and meet planned objective(s).

Loose residue to be retained on the field shall be uniformly distributed on the soil surface. Combines shall use spreaders capable of redistributing residue over at least 80 percent of the working width of the header.

Residue shall not be burned.

Tillage implements shall be equipped to operate through plant residue without clogging, and to maintain residue on or near the soil surface by undercutting or mixing.

Planters, drills, or air seeders shall be equipped to plant in residue distributed on the soil surface or mixed in the tillage layer.

Tillage and planting operations, and the selection of equipment, shall be managed to achieve the planned amount, distribution, and orientation of residue after planting or at other essential time periods.

Partial removal of residue by means such as baling or grazing shall be limited to retain the amount needed.

See Exhibit A and B for information on crop residue production and management.

Conserving Soil Moisture:

A minimum quantity of 50 percent residue cover shall be maintained on the soil surface throughout the year.

Managing Snow:

Stubble height shall not be less than 6 inches throughout the winter to trap and retain snow.

Fall tillage operations shall be limited to undercutting tools such as blades, sweeps, or deep tillage implements such as rippers or subsoilers, to maintain stubble in a standing condition.

Food and Escape Cover for Wildlife:

1. Stubble shall be maintained standing over winter.

2. Tillage shall be delayed until spring in order to maintain grain on the soil surface.

Operation and Maintenance

1. Special precautions must be taken to ensure that perennial weeds such as bindweed, johnsongrass, and blueweed are not allowed to build up.

2. Appropriate actions must be taken as needed for insect control, particularly around field boundaries, fences and other infectious sites.

3. Special attention is needed to ensure that eroded areas are repaired in a timely manner.

4. Proper operation and maintenance of equipment is needed to enhance this practice.

The following exhibits may be used as a guide in determining the average amount of residue production by crops and how tillage changes those quantities on the soil surface.

EXHIBIT A
ESTIMATED AIR DRY RESIDUE PRODUCTION BY VARIOUS CROPS

Crop	Lbs of Air Dry Residue Expected			
Wheat	100	to	135	per Bushel of Grain
Rye	100	to	120	per Bushel of Grain
Barley	80	to	90	per Bushel of Grain
Oats	50	to	70	per Bushel of Grain
Corn	60	to	70	per Bushel of Grain
Sorghum	70	to	90	per Bushel of Grain
Cotton	3	to	4	per Pound of Lint

EXHIBIT B
CROP RESIDUE

CROP RESIDUE MANAGEMENT

Classes of Crop Residue

(1) Crop residue has been generally classified as being either Non-Fragile or Fragile.

(2) The classification of residue as Non-Fragile or Fragile is a subjective classification based in part on the ease in which crop residue is decomposed by the elements or buried by tillage operations.

(3) Plant characteristics such as composition and size of leaves and stems, density of the residue, and relative quantities produced are considered when assigning classifications.

(4) Table #1 lists agronomic and horticultural crops that are generally considered as having Fragile crop residue.

(5) Table #2 lists agronomic and horticultural crops that are generally considered as having Non-Fragile residue.

TABLE 1
CROPS WITH FRAGILE RESIDUE

Canola/Rapeseed	Guar	Soybeans
Dry Beans	Lentils	Sugar Beets
Dry Peas	Mint	Sunflower
Fall Seeded Cover Crops	Mustard	Sweet Potatoes
Flower Seed	Peanuts	Vegetables
Grapes	Potatoes	
Green Peas	Safflower	

TABLE 2
CROPS WITH NON-FRAGILE RESIDUE

Alfalfa or legume hay	Forage Silage	Sorghum
Barley	Grass Hay	Spelts*
Buckwheat	Millet	Sugarcane
Corn	Oats	Triticale*
Cotton	Pasture	
Flaxseed	Popcorn	
Forage Seed	Rye*	

* If a combine is used with a straw chopper or otherwise cuts straw into small pieces in harvesting small grain, then the residue should be considered as being fragile.

Note: The classifications listed in Tables #1 and #2 are accepted by the Agricultural Research Service (ARS) and by the Equipment Manufacturers Institute (EMI).

Residue Burial

(1) Tillage implements and other types of field equipment are the most important factors influencing residue burial and the rate of residue decomposition.

(2) Field operations bury crop residue and mix them with the soil, reducing the amount of residue on the soil surface and increasing the rate of decomposition.

(3) To plan crop residue management systems for erosion control or other conservation purposes requires a general working knowledge of the degree to which tillage and other field implements bury crop residue, and how much residue is likely to remain on the soil surface after a single pass of that implement.

(4) Each tillage or planting operation leaves a percent of the residue that was present just prior to that operation. The numbers in Table #3 represent these remaining percentages.

(5) Many factors affect the amount of residue left after each tillage or planting operation. Residue levels are sensitive to the depth and speed of equipment operation, and to row spacing.

(6) Under some conditions, field cultivators, other finishing tools with field cultivator gangs, and some planters and drills return to the surface as much as 20 percent of the residue incorporated at shallower depths by operations that have recently occurred.

(7) The following general rules of thumb should be used when selecting values from the ranges listed in Table #3:

(a) Select values from the lower end of the range in situations where equipment is used at deeper operating depths. At shallower operating depths, more residue is left on the surface; while at deeper operating depths, more residue is buried.

(b) Select values from the upper end of the range in situations where equipment is operated at slower speeds. Slower operating speeds tend to leave more residue on the surface; while faster speeds bury more residue.

(8) The values in Table #3 may be used as a guide in selecting the types of equipment and types of blades, points, or sweeps to be used in a residue management system. Field measurements of the actual amounts of residue being left by an operation should be made, and adjustments made accordingly.

TABLE 3
RESIDUE RETENTION-BURIAL, IMPLEMENT OPERATING DATA

Implements:	**Residue Remaining (Percent)**		**Depth of Operation**
	Fragile Residue	Non-Fragile Residue	(Inches)
PLOWS			
Moldboard Plow	0-5	0-10	4-8
Disk Plow	5-15	10-20	4-8
MACHINES WHICH FRACTURE SOIL			
Paratill/Paraplow	75-85	80-90	8-12
“V” Ripper/Subsoiler			
12”-14” deep 20” spacing	60-80	70-90	10-16
Combination Tools:			
Subsoil-chisel	40-50	50-70	10-16
Disk-subsoiler	10-20	30-50	8-16
CHISEL PLOWS With			
Sweeps	50-60	70-85	4-8
Straight chisel spike points	30-60	40-80	4-8
Twisted points or shovels	20-40	35-70	4-8
COMBINATION CHISEL PLOWS			
Coulter Chisel plows with:	40-50	60-80	4-8
Sweeps	25-40	30-60	4-8
Straight chisel spike points	10-30	25-60	4-8
Twisted points or shovels			
Disk Chisel plows with:	30-50	60-70	4-8
Sweeps	25-40	30-60	4-8
Straight chisel spike points	10-30	20-50	4-8
Twisted points or shovels			
UNDERCUTTERS			
Stubble-Mulch sweep or blade plows with:			
Sweep/”V”-Blade > 30” wide	60-80	75-95	3-6
Sweeps 20”-30” wide	50-75	70-90	3-6
DISK			
Offset			
Heavy plowing > 10" spacing	10-25	25-50	4-8
Primary cutting > 9" spacing	20-40	30-60	4-8
Finishing 7”-9" spacing	25-40	40-70	2-6
Tandem			
Heavy plowing > 10" spacing	10-25	25-50	4-8
Primary cutting > 9" spacing	20-40	30-60	4-8
Finishing 7"-9" spacing	25-40	40-70	2-6
Light tandem disk after harvest, before other tillage	40-50	70-80	2-4
One-way disk with:			
12"- 16" blades	20-40	40-50	4-8
18"-30" blades	10-30	20-40	4-8
Single gang disk	40-60	50-70	2-6

TABLE 3 (Continued)
RESIDUE RETENTION-BURIAL, IMPLEMENT OPERATING DATA

Implements:	**Residue Remaining (Percent)**		**Depth of Operation**
	Fragile Residue	Non-Fragile Residue	(inches)
FIELD CULTIVATORS: (Including leveling attachments)			
Used as the primary tillage operation:			
Sweeps 12”-20”	55-75	60-80	4-6
Sweeps or shovels 6”-12"	50-70	35-75	4-6
Duckfoot points	30-55	35-60	2-4
Field cultivators as secondary operation following chisel or disk:			
Sweeps 12”-20"	60-75	80-90	2-4
Sweeps or shovels 6”-12"	50-60	70-80	2-4
Duckfoot points	35-50	60-70	2-4
FINISHING TOOLS			
Combination finishing tools with:			
Disks, shanks and leveling attachments	30-50	50-70	2-4
Spring tooth & rolling basket	50-70	70-90	2-4
Harrows			
Springtooth (coil tine)	50-70	60-80	2-4
Spike tooth	60-80	70-90	2-4
Flex-tine tooth	70-85	75-90	2-4
Roller harrow (cultipacker)	50-70	60-80	1-2
Packer roller	90-95	90-95	1-2
Rotary Tiller			
Secondary operation 3” deep	20-40	40-60	3
Primary operation 6” deep	5-15	15-35	6
RODWEEDERS			
Plain rotary rod	50-60	80-90	2-4
Rotary Rod with semi-chisels or shovels	60-70	70-80	2-4
STRIP TILLAGE MACHINES			
Rotary tiller, 12” tilled on 40” rows	50-60	60-75	4-6
ROW CULTIVATORS (30” and wider)			
Single sweep per row	55-70	75-90	1-3
Multiple sweeps per row	55-65	75-85	1-3
Finger wheel cultivator	50-60	65-75	1
Rolling disk cultivator	40-50	45-55	1-3
Ridge Till cultivator	5-25	20-40	1-3
UNCLASSIFIED Machines			
Anhydrous applicator	45-70	75-85	4-8
Anhydrous applicator with closing disks	30-50	60-75	4-8
Subsurface manure applicator	40-60	60-80	4-8
Rotary Hoe	80-90	85-90	1
Bedders, lister & hippers	5-20	15-30	2-6
Furrow diker	75-85	85-95	2-6
Mulch Treader	60-75	70-85	2-4

TABLE 3 (Continued)
RESIDUE RETENTION-BURIAL, IMPLEMENT OPERATING DATA

Implements:	**Residue Remaining (Percent)**		**Depth of Operation**
	Fragile Residue	Non-Fragile Residue	(inches)
DRILLS			
Hoe Opener drills	40-60	50-80	1-2
Semi-deep furrow drill or press drill (7"-12" spacing)	50-80	70-90	1-2
Deep furrow drill with > 12" spacing	50-80	60-80	1-2
Single disk opener drills	75-85	85-100	1-2
Double disk opener drills (conventional)	60-80	80-100	1-2
No-till drills and drills with the following attachments in standing stubble:			
smooth no-till coulters	70-85	85-95	1-2
Ripple or bubble coulters	65-85	80-85	1-2
Fluted coulters	60-80	75-80	1-2
No-till drills and drills with the following attachments in flat residue:			
Smooth no-till coulters	50-70	65-85	1-2
Ripple or bubble coulters	45-65	60-75	1-2
Fluted coulters	40-60	55-70	1-2
Air seeders: (Refer to appropriate field cultivator or chisel plow depending on the type of ground engaging device used.)			
Air drills: (Refer to corresponding type of drill opener.)			
ROW PLANTERS			
Conventional planters with	80-90	85-95	1-2
Runner openers	85-95	90-95	1-2
Staggered double disk openers	75-85	85-95	1-2
Double disk openers			
No-till planters with	75-90	85-95	1-2
Smooth coulters	70-85	75-90	1-2
Ripple coulters	55-80	65-85	1-2
Fluted coulters			
Strip till planters with			
2 or 3 Fluted coulters	50-75	60-80	1-2
Row cleaning devices	50-60	60-60	1-2
(8”-14" wide bare strip using brushes)			
Ridge till planter	20-40	40-60	1-2
CLIMATIC EFFECTS			
Over winter weathering			
Following summer harvest	65-85	70-90	1-2
Following winter harvest	70-80	80-95	1-2

(10) References:

(a) Natural Resources Conservation Service (USDA) and Equipment Manufactures Institute, 1992, as revised 1993. "Estimates of Residue cover Remaining After Single Operation of Selected Tillage Machines."

(b) Agricultural Research Service, National Soil Erosion Research Laboratory, West Lafayette, Indiana